Research Report

The Montessori Preschool Landscape in the United States:
History, Programmatic Inputs, Availability, and Effects

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RESEARCH REPORT

The Montessori Preschool Landscape in the United States: History, Programmatic Inputs, Availability, and Effects

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The Day 1 Academies Fund aims to support a network of high-quality, full-scholarship, Montessori-inspired preschools in underserved communities. To provide insight into the fund's pedagogical inspiration, in this report I provide a high-level overview of the Montessori preschool landscape in the United States. This overview includes 5 key programmatic elements of a traditional Montessori approach to teaching and learning in classrooms serving preschool-aged children, the reported availability of Montessori programs that enroll 3- and 4-year-old children, and what is known about enrollees' demographics. To situate this information in the larger, publicly financed, early education policy context, I also provide similar data for state-funded pre-K and federally funded Head Start programs for preschoolers. In addition, I review research on children's outcomes after participating in U.S.-based Montessori preschool and elementary programs. This overview provides some context for understanding how the Day 1 Academies Fund eventually defines the constructs of high quality, Montessori inspired, and underserved. This review also suggests it could be useful for the Fund's stakeholders to undertake short-term research examining the current early education options of families with low incomes living in potential low-access-to-Montessori states as well as long-term research aimed at expanding the research base on the effects of Montessori programs aimed at preschoolers.

Jeff Bezos, the CEO of Amazon, recently announced his $2 billion Day One Fund, part of which is slated to support the Day 1 Academies Fund "network of high-quality, full-scholarship, Montessori-inspired preschools in underserved communities" (Bezos, 2018, 3/4, para. 4). The announcement did not specify the Day 1 Academies Fund total budget or years of funding. However, it is worth noting that $1 billion — or half of the Day One Fund total — is roughly equivalent to 2016–2017 state-funded pre-K[1] spending in the District of Columbia, Florida, Oklahoma, Vermont, and Wisconsin, all of which enrolled at least 70% of all 4 year olds in their respective jurisdictions (Friedman-Krauss et al., 2018). When combined with additional philanthropic support for the expansion of Montessori and other early education programs (Reilly, 2018; Trust for Learning, 2018), Bezos's announcement has understandably generated a great deal of excitement.

At the same time, because the details of the Day 1 Academies Fund have not yet been released, parents, policymakers, researchers, and other education stakeholders are curious to learn about the programmatic inputs to be incorporated (Au-Yeung, 2018; Cramer & Barnum, 2018; Day & Romano, 2018; Herold, 2018). This interest stems, in part, from research emphasizing the importance of looking beyond the mere provision of preschool "slots" if the goal is to improve young children's developmental outcomes (Morris et al., 2018; Reynolds et al., 2017; Weiland, McCormick, Mattera, Maier, & Morris, 2018). However, this curiosity also likely emanates from a lack of knowledge about the Montessori approach to educating 3- and 4-year-old children, including research on its effects (Hiles, 2018; Murray, 2012).

In this report, I provide a high-level overview of the Montessori preschool landscape in the United States. This overview includes five of the key programmatic elements of a traditional Montessori approach to teaching and learning in classrooms serving preschool-aged children, the current availability of Montessori programs that enroll 3- and 4-year-old children, and what is known about enrollees' demographics. To situate this information in the larger, publicly financed, early education policy context, I also provide similar data for state-funded pre-K and federally funded Head Start programs for preschoolers. In addition, I highlight research on children's outcomes after participating in U.S.-based Montessori preschool and elementary programs. To set the stage for this overview, I first describe the history of Montessori education. I conclude the report with two Montessori-relevant topics for future research.

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The History of Montessori Schools

Montessori schools are named after Maria Montessori, the early 20th-century Italian medical doctor and educator. Dr. Montessori viewed the developmental period up to age 6 as a time when children are not only naturally curious, but also expanding their expressive and receptive language skills, fine and gross motor capacity, and ability to concentrate on and persevere with tasks. Based on this understanding, Dr. Montessori theorized that young children could best learn by absorbing and interacting with different aspects of their environment, as opposed to being directly taught specific knowledge and skills. Furthermore, to support young children in this intrinsic "creative work," Dr. Montessori posited that it is important to provide them with the appropriate physical and social learning opportunities (Montessori, 1995).

Today's Montessori approach to teaching and learning developed not only out of Dr. Montessori's pedagogical theories, but also from her psychiatric clinic work with children with special needs who lived in Rome's asylums. Through this work, she came to perceive the children's mental challenges as issues resulting from deficiencies in their environment, as opposed to actual medical problems. In 1900, Dr. Montessori became codirector of a state school for training special education teachers. As part of this effort, she began working with the asylum children and using materials she designed herself. These materials were intended to teach individual concepts and drew on multiple senses, including touch. This approach was so successful that several of the children learned to read and write and received above average scores on state examinations (A. Lillard, 2005; Thayer-Bacon, 2012).

In 1901, Dr. Montessori resigned from her position at the teacher training school so that she could study education and determine if her sensorial materials could advance the learning of young children without special needs. Dr. Montessori had the chance to test out her hypothesis in 1907 when she took on the job of supervising 60 3- to 6-year-old children who lived in a slum district of Rome where a housing project was being built. The builders did not intend for this job to be an educational endeavor. Instead, they simply wanted to prevent the children from running around and defacing the building sites. Dr. Montessori's solution was to open the first Casa dei Bambini. At her direction, the one-room Casa eventually provided the children with an all-day home away from home, including a main meal and child-sized tables and chairs. It was staffed by a young female directress, whom Dr. Montessori chose due to her lack of any prior training and, equally important, any preconceived ideas regarding how children learn. Dr. Montessori wanted the children to move around the room and choose their own activities, which consisted of toys, practical "life activities," and the materials she had developed for the asylum children. The directress's role was limited to observing the children and noting their behavior and the activities in which they participated (A. Lillard, 2005; Thayer-Bacon, 2012).

The children's outcomes were so successful that by 1908 Dr. Montessori began working on her pedagogical approach on a full-time basis. This endeavor included opening additional schools for children in Italy, training teachers in Italy and across the globe, and authoring books. As word of her work spread, the first U.S. Montessori school opened in October 1911 and quickly caught the attention of scientists, dignitaries, and the well-to-do of society. However, this interest waned after World War I (M. Debs, 2019; Thayer-Bacon, 2012; Whitescarver & Cossentino, 2008).

Although the 1929 launch of the Association Montessori Internationale (AMI) helped promote additional interest in Dr. Montessori's pedagogical approach, its reintroduction to U.S. families did not take place until a group of prominent Greenwich, Connecticut, families opened a private Montessori preschool in 1958. As additional private Montessori preschools opened, the American Montessori Society (AMS) was formed, as well. Since then, Montessori education has expanded on a limited basis into the publicly funded preschool sector (and a point to which I return below) via Head Start, the federally funded program that began in 1964 for 3- and 4-year olds from low income families, and state-funded pre-K programs, which mainly have been in operation over the past two decades. In addition to programs serving preschoolers, Montessori education received another boost in the late 1960s and 1970s as large urban K–12 school districts incorporated this approach in response to the Civil Rights movement. Since then, additional urban districts have viewed Montessori charter and magnet schools as a school reform and racial diversity vehicle (Cascio & Schanzenbach, 2014; M. Debs, 2019; M. C. Debs & Brown, 2017; Friedman-Krauss et al., 2018; Miller & Dyer, 1975; National Center for Montessori in the Public Sector, 2014, 2016; Thayer-Bacon, 2012; Whitescarver & Cossentino, 2008; Zigler & Styfco, 2010).

Key Programmatic Inputs

As was the case when Dr. Montessori opened the first Casa dei Bambini, one key decision to consider when designing both small- and large-scale preschool initiatives aimed at enhancing at-risk children's learning and development is which

programmatic inputs to incorporate (Ackerman, Barnett, Hawkinson, Brown, & McGonigle, 2009; Reynolds et al., 2017). Early childhood stakeholders generally consider these inputs to fall under the *structural* or *process* umbrellas. Structural factors are defined as the regulatable features of a program that protect children from harm and support teaching and learning, meaning they can focus on such diverse inputs as playground equipment and the minimum amount of daily instructional time. In contrast, the process characteristics are the educational experiences available to children. These experiences can include the curriculum and the ways in which students interact with their teachers and peers (Huston, 2015). All of these inputs can be further characterized in terms of the degree to which they meet particular professional or organizational standards of quality (e.g., Friedman-Krauss et al., 2018; National Association for the Education of Young Children, 2018; U.S. Department of Health and Human Services, 2016).

Although it is challenging to highlight the many aspects of a Montessori pedagogical approach as part of a high-level overview, in light of the Day 1 Academies Fund intention to operate a network of high-quality, Montessori-like preschools, in this section I describe five traditional structural and process inputs that are considered to be indicators of high quality in classrooms in which 3- and 4-year-old children are enrolled. To situate these Montessori inputs in the larger publicly financed, early education sector, I also highlight the ways in which they are similar to—or different from—the programmatic aspects typically found in high-quality state-funded pre-K and federally funded Head Start classrooms.

Structural Quality Inputs

Age Grouping, Class Size, and Teacher–Child Ratio

The first defining structural feature of traditional Montessori preschool and elementary programs is the student and teacher-related classroom composition, including the intentional use of three-year age groupings (e.g., 3 to 6 year olds). Depending on the specific Montessori affiliation, classrooms that include preschool-aged children in this grouping can be referred to as *early childhood rooms* or *primary rooms*. Because of the emphasis on self-paced learning—discussed in more detail below—such a configuration aims to provide students with adequate time to master targeted skills, as well as the opportunity to learn from other students and to develop strong relationships with a classroom teacher. In addition, to promote peer-to-peer rather than teacher-directed learning, a single classroom may be staffed by a teacher and assistant and have as many as 35 children (A. Lillard, 2005, 2013; Marshall, 2017; Montessori Public Policy Initiative, 2015; National Center for Montessori in the Public Sector, 2016).

In comparison, just as kindergarten classrooms in most public elementary schools are limited to age-eligible students (Ackerman & Barnett, 2005), typical Head Start and state-funded pre-K classrooms are organized with classrooms composed of children who are roughly the same age (e.g., already 4 years old or closer to their fourth birthday than their third birthday). Like the Montessori affiliates, the majority of classrooms in these two latter settings are staffed by a teacher and an assistant. However, class sizes are capped at 20 children as a means for promoting a teacher's capacity to interact with and differentiate his or her instruction for individual children, as well as work with small groups (Friedman-Krauss et al., 2018; Head Start Early Childhood Learning & Knowledge Center, 2018).

Teacher Preservice Training

A second key input difference between traditional Montessori and publicly funded pre-K programs is the formal credential teachers need to attain prior to being hired and, in turn, the programs in which preservice teachers enroll as a means for achieving such a credential. United States-based Montessori teachers are typically trained in certificate- or diploma-granting teacher education programs affiliated with AMS (2018b) or AMI (2018). Another alternative is the array of training centers that are not affiliated with either of these organizations but are accredited by the Montessori Accreditation Council for Teacher Education (MACTE; 2018). As of Fall 2018, less than 25% of the training centers across all three organizations were reported to be college or university based, meaning completion of these programs does not necessarily result in an individual receiving an initial or additional bachelor's (BA) or master's (MA) degree. Of course, Montessori teachers may complete coursework leading to a BA or MA outside of their preservice training. In fact, individuals seeking a full early childhood credential from an AMS-affiliated program must have a minimum of a BA (AMS, 2018c), and a BA is preferred, but not required, when completing AMI training (A. S. Lillard et al., 2017). In contrast, teachers in the majority of state-funded pre-K programs—and particularly if the classroom is located in a public school—must receive

their preservice training from degree-granting (e.g., BA or MA) teacher preparation programs. Head Start Performance Standards also require all lead teachers to have early childhood education training, and 50% are required to have a BA or higher (Barnett & Friedman-Krauss, 2016; Friedman-Krauss et al., 2018).

These different preparation routes may have additional implications for teachers aiming to work in classrooms that enroll preschool-aged children. For example, conventional university-based teacher education programs have been criticized for placing an emphasis on meeting general BA or MA degree requirements at the expense of sufficient pedagogical coursework and clinical experiences (Martin & Mulvihill, 2017). Because Montessori teacher training programs do not necessarily result in individuals receiving an initial or additional degree, they can focus solely on preparing teachers to work in these settings and with a specific age range of children. On the other hand, a survey study of 82 AMS-credentialed Montessori and 168 non-Montessori early childhood teachers in a single state suggested that individuals trained in conventional university-based teacher preparation programs were more likely to indicate that they had appropriate knowledge about supporting identified special needs students. This perception was correlated with the completion of special education coursework (Danner & Fowler, 2015). In addition, the limited number of university-based Montessori teacher training programs has been cited as a challenge to training a more culturally and linguistically diverse teacher workforce (M. Debs, 2019; M. C. Debs & Brown, 2017; Jor'dan, 2017).

Process Quality Inputs

Use of Materials

A third key programmatic input across state-funded pre-K and Head Start settings is the hands-on equipment and supplies used to support children's learning and development. Such equipment can include books, blocks, a sand or water table, and material to support children's creative development (e.g., paint and an easel; Harms, Clifford, & Cryer, 2015). Similarly, traditional Montessori classrooms rely on a full set of *prepared environment materials*, referring to materials that are common across sites. Although a full discussion of these materials is deserving of its own report, a defining Montessori process input that is useful to highlight here is the manner in which these didactic materials are used to sequentially teach concepts and work together as preparation for young children's future development and learning (Cossentino, 2009; Laski, Jor'dan, Daoust, & Murray, 2015; A. Lillard, 2005, 2013; Marshall, 2017).

For example, before traditional Montessori students learn to write, they practice a variety of fine motor skills, including lifting small wooden cylinders out of a case as a means for developing their thumb–index finger grip use. The type of cylinders and cases used as part of this experience grow progressively more challenging. Then, after mastering all of the cylinders, they will begin to develop their wrist movement skills by tracing geometric shapes. These materials also help children learn the names of the shapes. Phonics activities (tracing consonant and then vowel sandpaper letters and learning a letter's sound) are incorporated, as well. Writing activities only begin after a child shows proficiency in these activities (Candler, Mulder, & Nall, 2014; A. Lillard, 2005). In comparison, most Head Start and state-funded pre-K settings will also incorporate activities aimed at developing children's fine motor skills; however, they concurrently support emergent writing skills by providing daily opportunities for children to draw and even pretend to write letters or numbers. Such opportunities might include "signing in" to their classroom each day or "writing" as part of a classroom's different activity centers (Byington & Kim, 2017).

Role of the Teacher

Because Montessori preschoolers work at their own pace in mastering self-correcting activities, a fourth defining input within these programs is the pedagogical focus on following an individual child's lead. As a result, the teacher's role is intentionally decentered in the learning process and thus limited to implementing the appropriate Montessori lesson that supports each student's personal learning trajectory within a specific content area (Cossentino, 2009, 2017; Hiles, 2018; Marshall, 2017). Head Start classrooms and state-funded pre-K teachers are also expected to be attuned to a child's development and will differentiate their instruction in response to the child's skills and knowledge. However, these programs typically use curricula that are aligned with expectations for what children of a specific age should know and can do after participating in the program (and often referred to as learning standards). In turn, these curricula and standards can guide the focus of teachers' individual, small- and whole-group instruction over the course of the year (Dahlin & Squires, 2016; DeBruin-Parecki & Slutzky, 2016; Office of Head Start, 2018).

Use of Data

A final programmatic input, and one used across traditional Montessori early childhood or primary, state-funded pre-K and Head Start classrooms, is the use of data to support children's learning and development and improve program effectiveness. Although the measures and the frequency with which data are used vary within and across program types, teachers in all three settings gather data on students' skills and learning as a means for differentiating their instructional decisions. In addition, all three programs recognize the value of collecting data aimed at highlighting the degree to which classrooms and teachers meet program quality standards (Ackerman, 2019; AMS, 2018a; Ayer, 2016; Barnett & Friedman-Krauss, 2016; Friedman-Krauss et al., 2018; A. Lillard, 2013; Marshall, 2017; National Center for Montessori in the Public Sector, 2017).

Current Availability of Montessori Programs Aimed at Preschoolers

Bezos's Day 1 Academies Fund announcement did not specify the anticipated number of scholarship-supported preschools to be launched, but it did indicate that these schools will be located in underserved communities. *Underserved* generally is defined as inadequate access to a specific service or product. For example, researchers have identified communities that are underserved in terms of access to fresh food (Giang, Karpyn, Laurison, Hillier, & Perry, 2008). Other researchers have identified gaps in families' access to both state-funded pre-K (Friedman-Krauss et al., 2018) and child care (Malik & Hamm, 2017).

To shed light on the current availability of Montessori programs that enroll 3- and 4-year-old children, I analyzed state-by-state, school-reported data collected by the National Center for Montessori in the Public Sector (2018), which reports that there are a total of 2,089 private, tuition-based Montessori schools and 518 public Montessori schools across the United States. These schools can be affiliated with AMI or AMS or independent from either organization. In addition, they can offer infant through secondary Montessori classrooms.

My analyses of these school-reported data indicated that 1,491 of all 2,089 private schools enroll children ages 3–6, as do 305 of the 518 public schools. Furthermore—and as can be seen in Figure 1—these data also suggest that the 1,796 public and private Montessori schools that enroll children in this age group may not be evenly distributed across states. For example, although every state appears to have at least one private school for children in this age group, half are located in California, Colorado, Florida, Illinois, New Jersey, New York, and Texas. Similarly, half of the public schools with classrooms serving preschoolers are located in the states of Colorado, Florida, and Texas, as well as Michigan, Minnesota, South Carolina, and Wisconsin. Of course, this supply may reflect the greater population density in these states as compared to others. Yet, 11 states appear to have just one or two public schools in which 3- and 4-year-old children can enroll, and 13 states do not appear to have any public Montessori schools for preschoolers.

South Carolina provides a glimpse of how Montessori preschool classrooms operate within the public school system. During the 2017–2018 school year, the Department of Education reported that 43 schools, most of which also included primary or elementary grades, had Montessori preschool classrooms. Although one early childhood center had 26 individual classrooms, half of the schools had just one or two classrooms. Furthermore, the majority of these sites used a "school within school" model. As the name suggests, this means that the Montessori classrooms share a building with a non-Montessori public school, as opposed to the entire school using a Montessori approach (South Carolina Department of Education, 2017).

I could not determine how many Montessori early childhood or primary classrooms participate in state-funded pre-K programs, which in 2016–2017 were available in 43 states and the District of Columbia (Friedman-Krauss et al., 2018). In fact, Montessori programs have been constrained from greater participation in state-funded pre-K initiatives due to class size, teacher–child ratio, and teacher degree and licensure regulations (Montessori Public Policy Initiative, 2017). However, during the 2016–2017 school year, a Montessori curriculum was specifically approved for use in public schools and private centers that contracted to provide state-funded pre-K in Arkansas, the District of Columbia, Georgia, Illinois, Maryland, Michigan, Minnesota, South Carolina, and Tennessee (Friedman-Krauss et al., 2018).

As mentioned above, programs receiving federal Head Start funding—which operate in every U.S. state—have had the option to implement a Montessori approach as well (National Center for Montessori in the Public Sector, 2016). As is the case with state-funded pre-K, it is not clear how many of the 1,608 Head Start programs (National Head Start Association, 2018) in operation in 2017 might also be classified as public Montessori programs. However, my review of 2017 Program
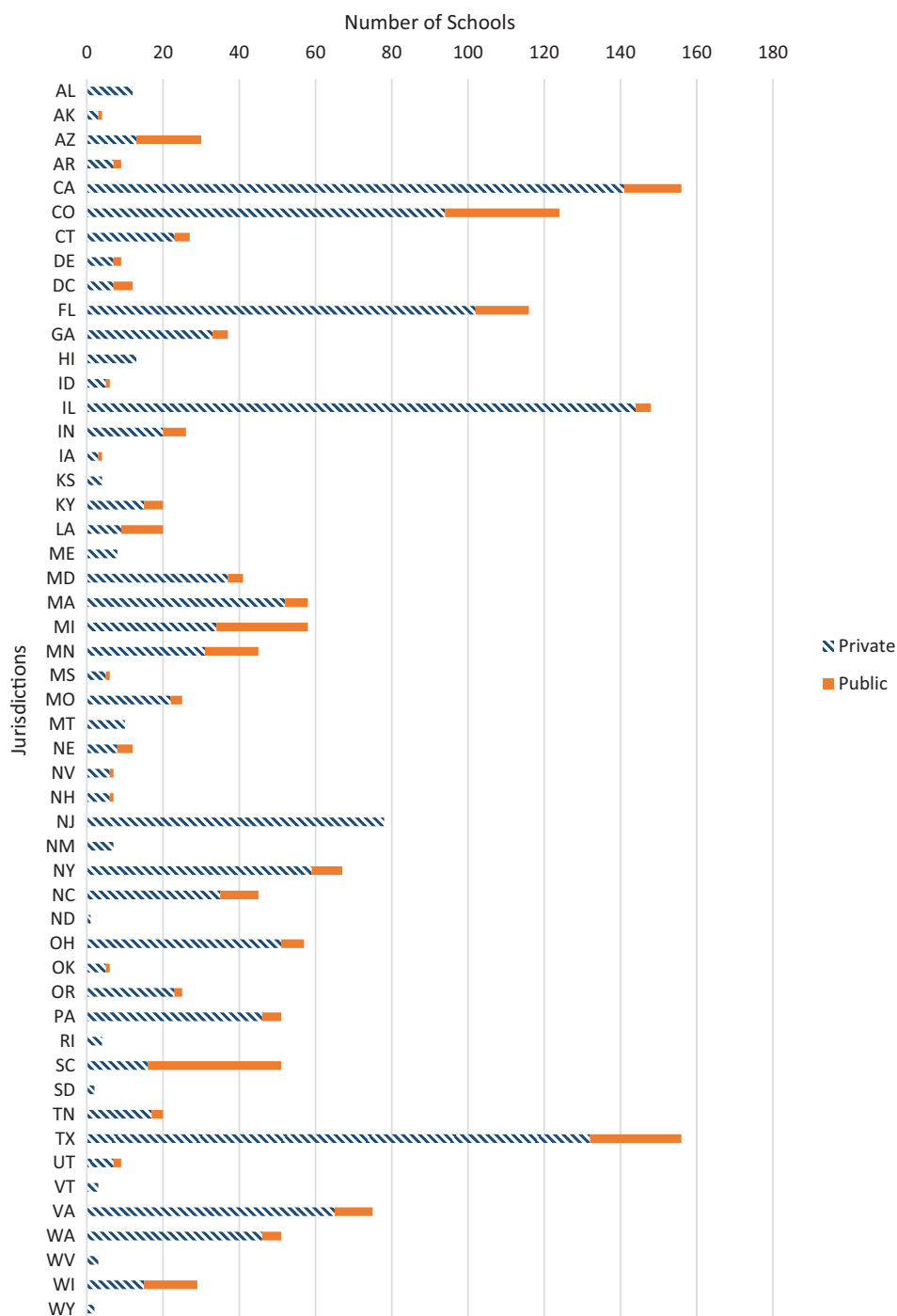
Figure 1 Number of private and public Montessori schools enrolling 3- to 6-year-old children.

Information Report data (Office of Head Start, 2018) showed that less than 1% of all programs reported using a Montessori or Montessori-method curriculum.

Data on Montessori Preschool-Aged Enrollees

Bezos's Day 1 Academies Fund announcement also did not specify the anticipated number of children to be enrolled in the fund's preschools. However, in addition to considering the number of programs already in operation, individuals

charged with ramping up large-scale preschool initiatives need to consider how many potentially eligible children might be served (Cascio & Schanzenbach, 2014). I therefore was interested to learn if any information exists regarding current levels of 3- and 4-year-old enrollment in Montessori programs, as well as students' ethnicity, home language, and family income.

Owing to the fact that Montessori schools can be affiliated with AMI or AMS, or completely unaffiliated with either organization, it is perhaps not surprising that I could not locate any data on the quantity of preschoolers enrolled across all private or public Montessori classrooms in the United States, much less their demographics. M. Debs (2018) estimated that 125,000 students ages 3–18 are enrolled in all public Montessori schools and less than half are reported to be White. Although my analyses suggest that 305 public schools—or 59% of the total—enroll preschoolers (and with the remaining schools presumably enrolling students in kindergarten and the elementary, middle, or secondary grades), it is difficult to estimate how many children between the ages of 3 and 6 are currently being served in these settings.

During the 2016–2017 school year, total enrollment in state-funded pre-K was 1,523,410. Thirty-two of the 60 state-funded pre-K programs have a maximum income requirement, as well. However, to my knowledge no data are available on the demographics of the entire population of children enrolled across these programs. Head Start, which served 703,000 3- and 4-year-old children from families with low incomes in its 2016–2017 federally funded programs (Friedman-Krauss et al., 2018), may be the only entity of the three options that can provide demographic data on all of its enrollees due to its central governance structure.

One criticism of Montessori programs has been that they enroll a disproportionate percentage of children from families with high incomes. Such an observation admittedly may be an apt description of any private school or educational approach that is funded mainly by tuition-paying students. However, this concern has also been expressed about publicly funded Montessori charter schools (M. Debs, 2019; M. C. Debs & Brown, 2017).

Two studies have explored this income issue using a sample of public school students. In the first, researchers compared the demographics of the 7,402 students enrolled in South Carolina's public Montessori schools during the 2015–2016 school year to their non-Montessori peers. The overall percentage of Montessori students who were reported to be White, Black, and Hispanic was not significantly different from cross-state enrollment data. However when comparing these data on a district-by-district basis, their analyses suggested that the Montessori students were more likely to be White and have a higher family income (Culclasure, Fleming, Riga, & Sprogis, 2018).

The second study examined the 2012–2013 overall student racial/ethnic and socioeconomic diversity of 300 public Montessori schools, half of which were located in urban areas. This study's results suggested that the racial makeup of the 94,613 kindergarten through Grade 12 students enrolled in these schools mirrored U.S. public school enrollment, with 55% of all students identified as Black, Latino, Asian/Pacific Islander, Native American, or multiracial. However, just 40% of students in these schools were eligible for free or reduced lunch, as opposed to the national average of 51% (M. C. Debs, 2016).

Research on the Impacts of Montessori Programs

An extensive research base documents the impacts of high-quality preschool on the early learning outcomes of 4-year-old children considered to be at risk (Yoshikawa et al., 2013), as well as reductions in rates of K–12 special education placement and grade retention (McCoy et al., 2017). However, this research focuses primarily on early education initiatives that used programmatic inputs more likely to be found in state-funded pre-K and Head Start than in traditional Montessori classrooms. Therefore, another focus of my study was to identify and review all of the research published since 2000 that has examined the effects of U.S. Montessori programs on young children's outcomes. Furthermore, as a means for determining the extent to which these studies have the potential to guide programmatic decisions made by the Day 1 Academies Fund initiative, I was particularly interested in the strength of the research designs used (e.g., large-scale randomized controlled trials versus less methodologically rigorous comparison studies of students enrolled in classrooms or schools chosen by their parents) and whether these studies included a sample of children from families with low incomes.

As can be seen in Table 1, the 16 studies I identified can be grouped according to the age of the student samples. In addition, these investigations are differentiated by their focus on cognitive gains versus other developmental skills, as well as the strength of their research designs and inclusion of low-income samples.

Table 1 Montessori outcome studies

Authors	Sample age or grade	Outcomes measured	Study design and sample strengths (+) and limitations (−)
Preschool Sample			
Ansari and Winsler (2014)	4 year olds	Cognitive, language, and motor skills	+Large-scale comparison study −Parents selected school enrollment +Low income sample
Byun, Blair, and Pate (2013)	4 years old	Students' activity levels	−Simple comparison study −Parents selected school enrollment −Samples differed
Lillard (2012)	3 to 6 years old	Executive function	−Simple comparison study −Parents selected school enrollment −Sample was not low income
Lillard and Heise (2016)	3 to 6 years old	Executive function, social problem solving, literacy, mathematics	−Simple comparison study −Parents selected school enrollment −Sample income not indicated
Lillard et al. (2017)	3 to 6 years old	Academic achievement, social problem solving, executive function	+Longitudinal, lottery-assigned comparison study −Small low-income sample
Pate et al. (2014)	4 years old	Students' activity levels	−Simple comparison study −Parents selected school enrollment −Samples differed
Yen and Ispa (2000)	3 to 5 years old	Students' activity levels	−Simple comparison study −Parents selected school enrollment −Sample income not indicated
Elementary Grade Sample			
Bhatia, Davis, and Shamas-Brandt (2015)	Kindergarten/age 5	Fine motor skills	−Simple comparison study −Parents selected school enrollment −Sample was relatively affluent
Brown & Lewis	Grade 3	Reading and mathematics	+Large-scale dataset −Parents selected school enrollment +Partial low-income sample
Culclasure et al. (2018)	Kindergarten to Grade 2	Executive function	+Longitudinal comparison study −Parents selected school enrollment −Sample income not indicated
Ervin, Wash, and Mecca (2010)	Kindergarten to Grade 2	Work habits	+Longitudinal comparison study −Parents selected Montessori enrollment +Partial low-income sample
Laski, Vasilyeva, and Schiffman (2016)	Kindergarten to Grade 3	Mathematics	+Longitudinal comparison study −Sample income not indicated
Lillard and Else-Quest (2006)	5 and 12 years old	Academic outcomes; Executive function	+Lottery-based comparison study +Partial low-income sample
Lopata, Wallace, and Finn (2005)	Grades 4 and 8	Mathematics and language arts	−Simple comparison study −Parents selected school enrollment +Partial low-income sample
Mallett and Schroeder (2015)	Grades 1 to 5	Reading and mathematics	−Simple comparison study −Parents selected school enrollment +Partial low-income sample
Rule and Stewart (2002)	Kindergarten	Fine motor skills	−Simple comparison study −Parents selected school enrollment −Teachers chose treatment or control +Partial low-income sample

Studies Using Samples of Preschoolers

The first group of studies compared the academic or executive function skill gains of children who were exclusively preschoolers or were enrolled in classrooms serving children ages 3 to 6. One methodologically strong study (Ansari & Winsler, 2014) analyzed data on the school readiness gains of 7,045 Latino and 6,700 African-American public school pre-K students, almost all of whom qualified for free or reduced-price lunch. Their classrooms used either the Montessori curriculum or the HighScope (2019) curriculum[2] with a literacy supplement. Although the students were not randomly assigned to these classrooms, the size of the sample, as well as their similar low-income status, provided the opportunity to compare their gains overall and by ethnicity. As expected, all of the students experienced gains in their cognitive, language, and motor skills, with neither curriculum appearing to offer an overall advantage. However, when examining the results for each group of students, the Latino students experienced larger gains when enrolled in the Montessori program (i.e., scoring in the 25th–35th percentile at the beginning of the school year, but above the 50th percentile after 1 year). In contrast, the African-American children enrolled in the High/Scope programs experienced only slightly higher gains as compared to their peers in the Montessori programs.

A second, 3-year study (A. S. Lillard et al., 2017) compared the academic achievement, social problem solving, and executive function outcomes of 141 ethnically diverse preschoolers. Half of the sample ($n = 70$) won a lottery at age 3 to attend two Hartford, Connecticut, public Montessori preschools, also creating a research-advantageous context. Analyses of this study's data suggested no difference in children's social problem solving or executive function outcomes. However, the Montessori students experienced better academic achievement outcomes at ages 4 and 5. This especially was the case when examining scores for children from families with low incomes. However, these latter analyses were limited due to the small size of the low-income subsample.

The remaining studies that relied on a sample of preschool-aged children are not as methodologically rigorous. For example, A. S. Lillard (2012) also compared the executive function gains of 172 3- to 6-year-old children enrolled by their parents in classrooms that already were using three different pedagogical approaches: those using only classic Montessori materials and in the prescribed Montessori manner ($n = 36$); classrooms that were considered to be supplemented Montessori (e.g., classic Montessori materials plus commercially available puzzles, games, blocks, or toys; $n = 95$), and non-Montessori, conventional classrooms ($n = 41$). The researcher hypothesized that the greater gains experienced by the classic students as compared to the 136 other students were due to demands of these activities on children's working memory, inhibition, and cognitive flexibility. However, for the purposes of informing the effects of Montessori on children from families with low-incomes, the author did not provide any family income information and 98% of the children's mothers reported that they completed a 4-year college degree or some graduate education.

A similar study (A. S. Lillard & Heise, 2016) compared the executive function, social problem solving, literacy, and math gains over the course of 4 months of 52 3- to 6-year-old children who were enrolled by their parents in three Montessori classrooms in a single school. Prior to the study, a head of school removed the non-Montessori, supplemented materials from the classrooms of two teachers who consented to this change, while the third teacher's classroom was left as is in terms of its supplemented materials. As was the case with A. S. Lillard's (2012) study, children in the two classic classrooms exhibited better executive function gains as compared to their peers in the supplemented classroom. They also experienced significantly higher early reading skill gains. However, differences in their vocabulary and early mathematics skill gains were not significant. The school in which these classrooms were located was somewhat diverse (70% White, 20% African American, and 10% Asian, multiracial, or other ethnicity), but this study was limited by its small sample. In addition, the authors did not provide any information about the socioeconomic status of the children's families.

The final three preschool age-focused studies compared the activity levels of students enrolled in Montessori and non-Montessori settings. In all three studies, the students were presumably enrolled by their parents, as opposed to being randomly assigned via a lottery. One of these studies (Yen & Ispa, 2000) aimed to determine whether the temperament of 102 3- to 5-year-old children appeared to moderate the impact of a Montessori versus *constructivist* (defined as having an emphasis on hands-on activities and collaborative learning) pedagogical approach. Although the authors noted that the Montessori classrooms did not follow an identical implementation model, all of the study's classrooms were otherwise considered to be of equal quality as measured by two early childhood observational rubrics. The children's mothers were somewhat homogeneous, with 79% self-identifying as White and 86% indicating that they graduated from college or had professional training. To address the study's focus, the mothers and the classroom teachers were surveyed regarding the children's classroom activity level and attention span/persistence. There were no differences in responses between

classroom types for the female students. However, boys who were reported to be highly active appeared to adjust better (as measured by the frequency of behavior problems) when enrolled in constructivist classrooms. The researchers hypothesized that this might be the case due to the emphasis in Montessori classrooms on quiet focus for longer periods of time.

Another study (Pate et al., 2014) examined the in- and out-of-school activity levels of 301 4-year-old children enrolled in both Montessori ($n = 145$) and traditional preschool classrooms. Children enrolled in the Montessori schools experienced more physical activity per hour as compared to those enrolled in the traditional preschools. Private Montessori students had higher levels of activity as compared to children in public Montessori schools, as well. However, this study was limited by the fact that Montessori students were more likely to be White and have parents with a college degree as compared to the traditional preschool sample.

Interestingly, a companion study (Byun et al., 2013) compared the level of sedentary behavior (defined as sitting) of 4-year-old children enrolled in public and private Montessori ($n = 164$) and traditional ($n = 167$) preschools. Analyses of the study's data suggested that students in the Montessori classrooms spent an average of 44.4 minutes/hour sitting versus 47.1 minutes/hour in the traditional classrooms. This gap widened slightly when examining the data for students in private schools (44.5 minutes in Montessori and 49.0 minutes in traditional classrooms). However, in public settings, the amount of sedentary time for Montessori students was slightly higher than for traditional students (46.2 minutes/hour versus 45.8 minutes/hour). In addition to the inconclusive results, the researchers did not provide any information regarding the curricula or activities in these settings. Another limitation of this study was differences between the samples, with 66% of the Montessori students identified as White and 65% of the classrooms located in private schools, whereas 37% of the traditional sample was White and 65% of the classrooms were located in public schools.

Studies Using Elementary Students

Another group of Montessori studies examine the outcomes of children enrolled in kindergarten alone or includes a sample of elementary grade students. In the first study researchers (A. S. Lillard & Else-Quest, 2006) compared the academic outcomes and executive function skills of 5- ($n = 55$) and 12-year-old ($n = 57$) children who entered a lottery to enroll in Milwaukee's public Montessori schools. Across both age groups, 59 students won the lottery to enroll, and the remaining 53 students served as the control group. As mentioned earlier, such lotteries provide the potential for a stronger research design. The parents in both groups had similar annual incomes between $20,000 and $50,000. Analyses of the study's data showed that the Montessori kindergartners had higher letter–word identification, phonological, and math skills scores and performed better on a test of their executive function. However, scores on tests of their vocabulary, spatial reasoning, and concept formation were similar for both groups of 5 year olds, as was a test of their behavioral regulation. In addition, the 12 year olds performed similarly on the standardized academic measures used.

Additional studies compare students' cognitive outcomes. Some of these studies are notable due to their use of large-scale datasets, a longitudinal design, or a low-income sample. However, none of these students were randomly assigned to classrooms via a lottery or other means. These results therefore need to be interpreted in light of the fact that parents selected the school in which their children enrolled. For example, a second study (Ervin et al., 2010) used a sample of 33 teachers and 256 kindergarten–Grade 2 public school students, the majority of whom were from families with low incomes, to examine teachers' perceptions of children's work habits (defined as needing supervision, being proactive, monitoring his learning, seeking out information, etc.) and social habits. Half of the children were enrolled in Montessori classrooms and the other half in non-Montessori classrooms, which in three of the districts coexisted in the same school buildings. Parents in these three "mixed approach" districts were able to select whether their child was placed in a Montessori classroom. The fourth district used a Montessori approach in the entire school. Twice as many of the participating teachers were from the Montessori classrooms ($n = 22$) due to their multiage configuration. Analyses of the study's data suggested that in contrast to the non-Montessori teachers, the Montessori teachers rated their students' work habits more favorably.

Researchers also recently examined 4 years of executive function-related data collected from a cohort of 200 South Carolina students beginning when they were enrolled in kindergarten (Culclasure et al., 2018). Half of these students were enrolled in one of the state's Montessori public schools and the remaining 100 students were enrolled in non-Montessori comparison schools. However, the researchers did not provide any demographic information about the sample. Analyses of these data did not show any advantage for either approach in the spring of kindergarten or Grade 4. In Grade 1, one

measure suggested an advantage for students in the non-Montessori classrooms. However, by Grade 2, a different measure demonstrated an advantage for the Montessori students.

A fourth study (Laski et al., 2016) compared the mathematical base 10–related knowledge and arithmetic problem solving strategies used by a sample of 150 kindergartners and Grade 1 students, all of whom were enrolled by their parents in either Montessori ($n = 104$) or non-Montessori ($n = 46$) classrooms. The researchers did not provide any demographic information about the sample. Although the Montessori kindergartners performed better on a block task to represent their base 10 understanding, by the end of Grade 1 there were no differences between the two groups. There also were no differences in the two groups' math strategies.

Brown and Lewis (2017) compared 7 years of Grade 3 reading and mathematics assessment scores for 335 African American students enrolled in three Montessori magnet schools and 1,348 African American students enrolled in three non-Montessori magnet schools in the same North Carolina district. The free and reduced-price lunch rates at all three schools ranged from 14% to 44%. These analyses suggested that the Montessori students scored significantly higher in reading as compared to their non-Montessori peers but had similar results on the state mathematics assessment.

A sixth study (Mallett & Schroeder, 2015) was situated in a single public school district in Texas and examined the 2011 standardized reading and math test scores of 1,035 Grades 1–5 Montessori ($n = 518$) and non-Montessori ($n = 517$) students. Forty-two percent of the sample was low income, but the Montessori students had to apply for admission. Researchers did not find a significant difference in students' Grade 1, 2, or 3 scores. Montessori students demonstrated a small advantage in Grades 4 and 5.

Another study (Lopata et al., 2005) compared the standardized math and language arts test scores of 543 Grades 4 and 8 students who were enrolled in four public Montessori or non-Montessori schools in New York. Although 67% of the sample was low income, three of the four study schools required parental choice. Analyses of these data did not demonstrate any consistent advantage for the Montessori students.

The two final elementary-aged studies examined the effects of Montessori activities on students' fine motor skills. The schools in which these students were enrolled were selected by their parents, as well. The first study (Bhatia et al., 2015) took place over 8 months and used a sample of 100 relatively affluent, mostly White kindergartners. Half of the sample was enrolled in private, tuition-based Montessori 3- to 6-year-old classrooms, and the other half were enrolled in a public elementary school's kindergarten classrooms. Consistent with the prepared environment pedagogical approach, the Montessori students had access to activities such as pouring items in jugs, funnels, and other containers, with the items progressing from easy (e.g., pasta) to more difficult (e.g., rice or sand and then water). Students who successfully mastered these pouring activities then were allowed to pour liquids to be served at lunch or snack time. Other activities to promote children's eye–hand coordination also were included. Analyses of the study's data suggested that the Montessori students experienced greater improvement of their fine motor skills. The second study (Rule & Stewart, 2002) used a sample of 186 kindergartners. All of these students were enrolled in 13 half-day public school classrooms that were not otherwise using a Montessori approach. Teachers in eight of the 13 classrooms were provided with Montessori-inspired materials and instructions on how to use them. Their kindergartners then had the option to use the materials during "center time." One major limitation of the study was that teachers chose to be in the treatment or control groups, and three of the control teacher's specifically selected this condition due to their past experience in implementing fine motor activities in their classrooms. Perhaps not surprisingly, this study did not demonstrate any advantage for students who had access to the Montessori-inspired materials.

In summary, I identified seven studies that examined the effects of enrollment in Montessori classrooms using samples of 3- and 4-year-old children or students enrolled in early childhood or primary Montessori classrooms, and an additional nine studies that used samples of kindergartners and elementary students. Although this research suggested that Montessori programs have the potential to enhance young children's learning and development, the results did not demonstrate a consistent advantage. In addition, the majority of these studies relied on simple comparison samples, rather than more rigorous lottery-based or randomized samples. Some of this research did not appear to have taken place in settings serving children from families with low incomes, as well. Moreover, some studies focused on children's school readiness, academic achievement, and executive function gains, whereas others focused on fine motor skills and activity levels.

Combined with the data presented above regarding current access to Montessori programs for preschoolers, there appears to be a significant range of Montessori-related studies to be conducted through future short- and long-term

research. I therefore discuss next two topics with particular relevancy to the planning of the Day 1 Academies Fund preschools.

Two Topics for Future Research

In this report I provided a high-level overview of the Montessori preschool landscape in the United States, including some of the key programmatic elements of a traditional Montessori approach to educating preschool-aged children and data on the reported number of private and public schools that enroll children between the ages of 3 and 6. To further an understanding of how Montessori fits within the larger, publicly financed, early education sector, I also provided similar information about state-funded pre-K and Head Start programs. In addition, I summarized prior research on children's outcomes after participating in U.S.-based Montessori preschool and elementary programs. All of these topics are timely in light of the recent Day 1 Academies Fund announcement regarding their future "network of high-quality, full-scholarship, Montessori-inspired preschools in underserved communities" (Bezos, 2018).

Although the Day 1 Academies Fund has not yet defined the constructs of high-quality, Montessori-inspired, and underserved communities, this report provides some context for understanding those eventual designations. In the meantime, the information reported here also suggests at least two potential research topics for Fund stakeholders to consider incorporating as they plan the specifics of the Day 1 Academies network: (a) short-term research on the extent to which families with low incomes living in geographically large states with a limited number of Montessori preschool programs have access to other high-quality, early education options, and (b) long-term research the effects of Montessori programs on the learning outcomes of children from families with low incomes.

High-Quality Early Education Options in Low-Access-to-Montessori States

As was noted above, the school-reported data I analyzed suggested that over half of all 1,491 private Montessori early childhood or primary programs are located in the seven states of California, Colorado, Florida, Illinois, New Jersey, New York, and Texas. In addition, half of the 305 public Montessori schools offering programs for children ages 3 – 6 appear to be once again concentrated in Colorado and Florida, as well as Michigan, Minnesota, South Carolina, Texas, and Wisconsin.

Of course, owing to the reliance on self-report, these data may not accurately reflect all schools with some type of Montessori approach or affiliation. Furthermore, just as such factors as maternal employment, child care preferences, and demand for a particular service at a specific price point contribute to the private child care market (Forry, Tout, Rothenberg, Sandstrom, & Vesely, 2013; Mocan, 2002), the supply of Montessori programs enrolling preschoolers in these 12 states is likely due to parents' demand for such services. Such demand may be correlated with the fact that these states have larger populations, as well. And, there probably is a connection between the number of public Montessori preschool programs, in particular, and the extent to which a state supports the creation of charter and magnet schools or school-within-school models.

Yet, the results reported here also suggest that 12 additional states may represent the opposite side of the supply continuum, especially when taking into their relative size in terms of square miles. More specifically, Idaho, Montana, Nevada, New Mexico, Oklahoma, and Utah are reported to each have a total of five to 10 Montessori sites that enroll preschoolers. Alaska, Iowa, Kansas, North Dakota, South Dakota, and Wyoming are reported to have no more than a total of four sites each. Most importantly, the limited access status of these 12 states has potential implications for families with low incomes seeking to enroll their preschooler in a free or scholarship-in-lieu-of-tuition early education program that incorporates high-quality structural and process inputs as a means for better supporting children's learning and development.

To underscore both the potential issue of underserved communities across these 12 states and the need for short-term, access-focused research, Table 2 displays the current reported number of public or private Montessori schools enrolling preschoolers, the percentage of children ages 0 to 8 in families living below 200% of the federal poverty level in 2016 (Kids Count Data Center, 2018), and the percentage of 3- and 4-year-old children served in state-funded pre-K and Head Start during the 2016 – 2017 school year (Friedman-Krauss et al., 2018). Although not a perfect proxy, these statistics provide insight into the degree to which children who typically would be eligible for means-tested early education programs are currently being served.

As can be seen in Table 2, 3-year-old enrollment in state-funded pre-K did not exceed 4% in any of these states. This statistic admittedly mirrors the national pre-K trend (Friedman-Krauss et al., 2018). Yet, six of these states do not offer

Table 2 Preschoolers enrolled in state-funded pre-K and head start in low-access-to-Montessori states

State	Montessori schools enrolling ages 3–6[a]	Age 0–8 below 200 percent poverty[b]	3 year olds enrolled		4 year olds enrolled	
			State-funded pre-K programs[c]	Head Start[d]	State-funded pre-K programs[e]	Head Start[f]
Alaska	4	36%	0%	10%	4%	13%
Idaho	6	48%	0%	4%	0%	9%
Iowa	4	39%	3%	6%	63%	4%
Kansas	4	42%	0%	6%	20%	7%
Montana	10	43%	0%	12%	0%	19%
Nevada	7	49%	1%	4%	5%	3%
New Mexico	7	59%	4%	13%	35%	15%
North Dakota	1	32%	0%	10%	0%	13%
Oklahoma	6	51%	4%	15%	73%	11%
South Dakota	2	42%	0%	14%	0%	16%
Utah	9	37%	0%	4%	0%	6%
Wyoming	2	32%	0%	8%	0%	10%

[a]Data from National Center for Montessori in the Public Sector (2018). [b]Data from Kids Count Data Center (2018). [c, d, e, f]Data from Friedman-Krauss et al. (2018).

publicly funded pre-K and eligibility for such programs in the six remaining states is mainly limited to 4 year olds. Head Start is offered across all 12 states to both 3- and 4-year-old children, but the percentage of 3 year olds enrolled ranged from 4% in Utah, Nevada, and Idaho to 14% in South Dakota and 15% in Oklahoma. In all 12 states, the percentage of 3 year olds enrolled was far less than the total percentage of children ages 0–8 in families potentially eligible to enroll in means-tested early education programs.

Variation in enrollment rates is much greater when looking at the data for 4 year olds across these 12 states. New Mexico, Oklahoma, and Iowa each enroll at least half of all children in this age group via the combination of state-funded pre-K and Head Start, suggesting each of these states may be serving the majority of children from families with low incomes. However, Alaska, Kansas, Montana, North Dakota, and South Dakota have enrollment rates between 13% and 27%. Total enrollment rates are 10% or lower in Utah (6%), Nevada (8%), Idaho (9%), and Wyoming (10%). Again, these latter enrollment rates are far lower than the poverty rates, suggesting some children who are eligible for means-tested early education are not enrolled.

The data presented in Table 2 admittedly do not provide definitive proof of lack of access within any one state. Yet, given the relative size of these states and the percentage of children living below 200% of the federal poverty rate, these data suggest that the majority of communities within these states may be considered underserved in terms of access for 3 year olds, and a similar situation exists in at least nine of the 12 states for 4 year olds. Therefore, a salient short-term research topic for Day 1 Academies Fund stakeholders to consider includes the following questions: What are the current free or scholarship-in-lieu-of-tuition early learning and development options available to families with low incomes in these states? What is the quality of these options, particularly for culturally and linguistically diverse families, as well as for children with identified special needs? And, in light of where families with young children live within each of these states, to what extent is there a sufficient quantity of trained teachers and preschoolers to offer new, Montessori-inspired early childhood or primary program age classrooms as a means for meeting these access needs?

Research on the Effects of Montessori on Young Children's Outcomes

This report also highlighted 16 studies that examined the effects of enrollment in Montessori education on young children's cognitive and developmental outcomes. This research is promising, especially given the role of school readiness and executive function skills in young children's learning and development (Ackerman & Friedman-Krauss, 2017; Duncan et al., 2007). However, in addition to the small quantity of studies, this research is limited in terms of the research designs used, sample demographics, and the conclusiveness of its results.

This research base could be enhanced by the inclusion of studies using larger sample sizes of children from families with low incomes from different ethnic and cultural backgrounds. In addition, it could benefit from studies that rely on lotteries that act as randomizers to a treatment and control group rather than merely comparing samples of children, particularly when parents have elected to enroll their child in the Montessori programs that serve as samples. The studies presented here also suggest that more research is needed that follows children over time as opposed to merely investigating gains over a few months.

Although two current research projects appear to be designed to help address these issues,[3] one additional topic for Day 1 Academies Fund stakeholders to consider is the extent to which its new network of Montessori-inspired, high-quality preschools might also provide the opportunity to conduct long-term research using a more rigorous design and diverse sample than has been the case. One potential program provision/research model can be found in KIPP public charter schools, 27 of which had pre-K classrooms in 2016. One notable aspect of a recent KIPP-based pre-K effects study was the reliance on a lottery to randomize the sample, as well as the inclusion within that sample of African-American and Hispanic students and children considered to be dual language learners. In addition, half of the sample had an annual household income of less than $25,000 (Knechtel, Coen, Caronongan, Fung, & Goble, 2017).

Another potential program provision/research model is Educare, which currently serves children between the ages of 6 weeks and 5 years in 21 high-quality Early Head Start and Head Start schools across the United States. (Educare, 2018). The majority of Educare students are minorities and roughly one third are dual language learners. Although Educare does not appear to use a lottery to determine enrollment, one defining feature of the entire network is its partnership with researchers as a means for generating data to inform continuous feedback and improvement cycle (Stein, Simon, & Britten, 2017; Yazejian et al., 2017).

Conclusion

This study expands our understanding of the U.S. Montessori preschool landscape. Such an understanding is useful given the recent establishment of a Day 1 Academies Fund "network of high-quality, full-scholarship, Montessori-inspired preschools in underserved communities" (Bezos, 2018). As is the case with high-quality state-funded pre-K and Head Start classrooms, traditional Montessori classrooms include programmatic inputs aimed at supporting young children's learning and development. However, existing research does not yet unequivocally demonstrate the benefits of enrollment in traditional Montessori classrooms for children from families with low incomes. In addition, access to public and private Montessori classrooms serving preschool-aged children may be uneven among states. The results reported here provide some context for understanding how the fund eventually defines the constructs of high-quality, Montessori-inspired, and underserved. These results also suggest it could be useful for the fund's stakeholders to undertake short-term research examining the current early education options of families with low incomes living in potential low-access-to-Montessori states, as well as long-term research aimed at expanding the research base on the effects of Montessori programs aimed at preschoolers.

Acknowledgments

Notes

1 Pre-K is defined here as the statewide programs that are funded, administered, and regulated by 43 states and the District of Columbia; primarily serve children who are 3- or 4-years-old; focus on early childhood education as opposed to subsidized child care; are not primarily aimed at children with disabilities, but may serve children with designated special needs; and meet at least 2 days per week (Friedman-Krauss et al., 2018).

2 HighScope is a research-based curriculum used in numerous conventional preschools, state-funded pre-K programs, and Head Start centers.

3 See the Institute for Education Sciences (IES)-funded study being conducted by Faria and Lillard (2018), as well as the Early et al. (2018) study funded by The Brady Education Foundation.

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